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STATIC STABILITY AND DRAG OF THE HOPI WEAPON (U)

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Aerodynamics Research Report 85

STATIC STABILITY AND DRAG OF THE HOPI WEAPON

Prepared by:

C. J. Carroll

ABSTRACT: This report presents the results of an investigation in the NOL Supersonic Tunnel No. 1 to measure the normal force, axial force, and pitching moment of the Hopi Weapon. These data were obtained at Mach numbers of 0.75, 0.90, 1.57, 2.17, and 3.25.

U. S. NAVAL ORDNANCE LABORATORY
White Oak, Maryland

NAVORD Report 6783

26 January 1960

The purpose of this investigation was to obtain normal force, axial force, and pitching moment on the Hopi Weapon. The wind-tunnel test was performed at the request of the U. S. Naval Ordnance Test Station (reference (a)), under task number NOL 415.

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JOHN A. QUENSE', Acting
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Commander

R. KENNETH LOBE
By direction

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ILLUSTRATIONS

Figure 1	Hopi Weapon Configuration
Figure 2	Hopi Weapon Fin Dimensions
Table I	Model Configuration and Test Information

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STATIC STABILITY AND DRAG OF THE HOPI WEAPON

INTRODUCTION

1. The Hopi Weapon is an air to surface, rocket assisted bomb being developed by the U. S. Naval Ordnance Test Station for the U. S. Navy.
2. This report gives the results of a wind-tunnel investigation performed to determine the normal force, axial force, and pitching moment at Mach numbers of 0.75, 0.90, 1.57, 2.17, and 3.25.

SYMBOLS

A	reference area ($\pi d^2/4$)
C	fin root chord length (in) (see Figures 1 and 2)
c.g.	center of gravity located at L/2
C_A	axial force coefficient (F_A/qA)
C_N	normal force coefficient (F_N/qA)
C_Q	pitching moment coefficient (M_Q/qAd)
d	reference diameter (0.978 in)
L	model length (in) (see Figure 1)
F_A	axial force (lbs)
F_N	normal force (lbs)
M	Mach number
M_Q	pitching moment (in-lbs)
q	dynamic pressure (psi)
R_1	nose ogive radius (in)
R_2	nose tip radius (in)
Re/ft	Reynolds number per foot
S	fin span (in) (see Figures 1 and 2)
Θ	angle of pitch in vertical tunnel center plane (deg)
ϕ	angle of roll (deg)

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MODEL NOMENCLATURE

3. A drawing of the Hopi weapon configuration is shown as Figure 1. Two body configurations (B_1 and B_2) were tested. These varied in length only, being 9.914 and 14.670 inches, respectively. There were 10 tail sections used in the test, one without fins and nine with different fin configurations, labeled F_1 through F_9 (see Figure 2).

TEST TECHNIQUES AND DATA REDUCTION

4. The data were obtained using a six-component internal strain-gage balance (reference (b)). These data were recorded on IBM cards using the automatic data recording system explained in reference (c). IBM 650 machines were used to reduce the wind-tunnel data to coefficient form using the equations given in reference (b). A correction was made to the data for the elastic deflection of the sting due to the aerodynamic loading.

5. The model was placed in the wind tunnel at 0° yaw and swept through an angle of pitch range from -6° to $+12^\circ$ in 2° increments. The roll attitudes tested were 0° and 45° .

TABULATED DATA

1. Model configurations tested and test information are listed in Table I.
2. Tabulated data follow Table I in sequence.
3. The symbols used in the column headings are defined on Page 1.
4. Runs are tabulated in sequence by Run Number.
5. Column headings are shown on Run 1 of the tabulated data and are the same for all runs.

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REFERENCES

- (a) Naval Ordnance Test Station Wind-Tunnel Request 481, Conf., 1958
- (b) Shantz, I., Gilbert, B. D., and White, C. E., "NOL Wind-Tunnel Internal Strain-Gage Balance System," NAVORD Report 2972, Unclass., 1953
- (c) Gilbert, B. D., "Automatic Data Processing System (ADAPS) for the Supersonic Wind Tunnels," NAVORD Report 2813, Unclass., 1953

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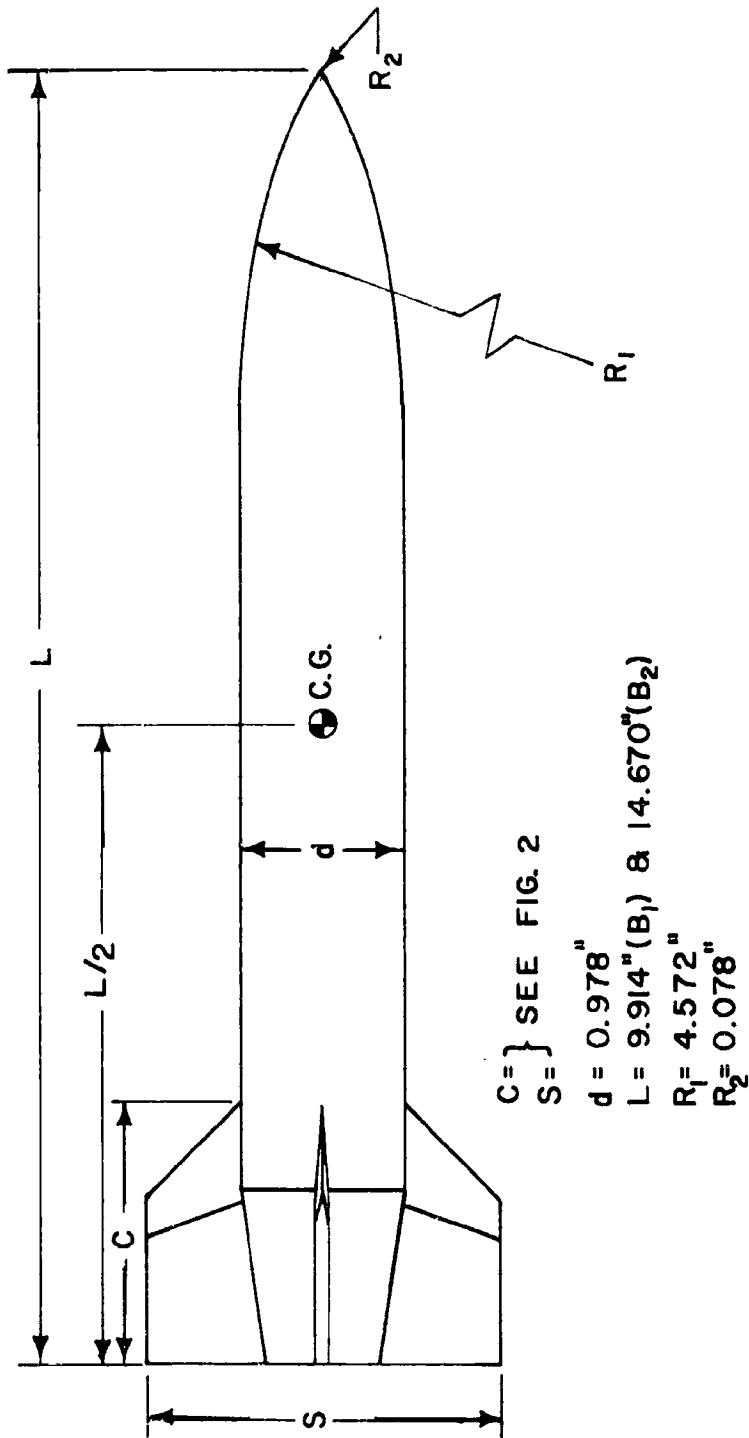
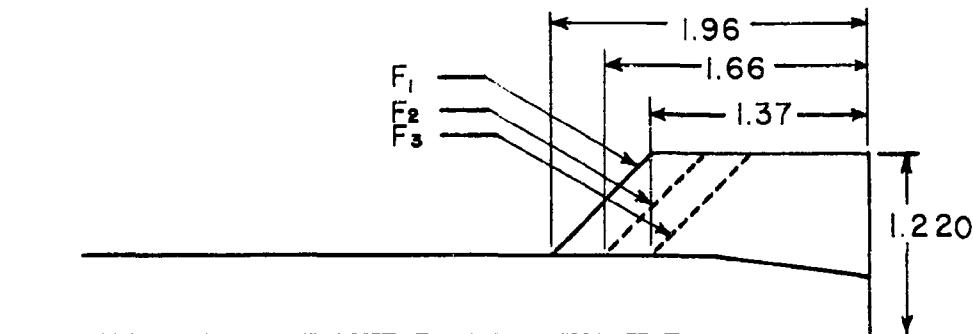


FIG. I HOPI WEAPON CONFIGURATION

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NOTE

ALL DIMENSIONS IN INCHES
FIN SPAN DIMENSIONS SHOWN
ARE EQUAL TO S/2

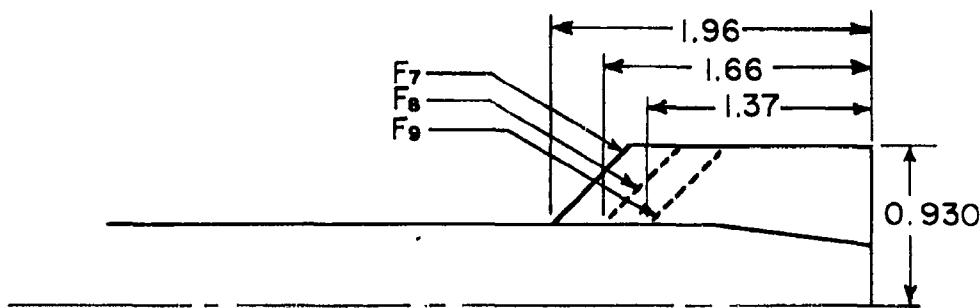
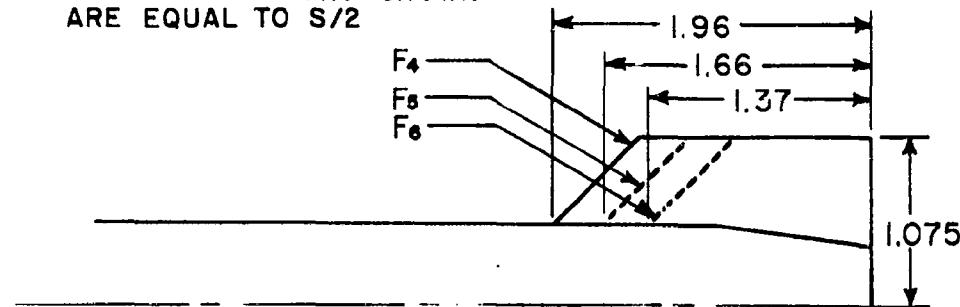


FIG. 2 HOPI WEAPON FIN DIMENSIONS

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TABLE I
MODEL CONFIGURATION AND TEST INFORMATION

Run	M	Config.	θ°	q (psi)	(Re/Ft) $\times 10^{-6}$
1	3.25	B ₁	0	2.01	2.1
2	3.25	B ₁ F ₂	0	2.01	2.1
3	3.25	B ₁ F ₂	-45	2.01	2.1
4	3.25	B ₁ F ₁	-45	2.01	2.1
5	3.25	B ₁ F ₃	-45	2.01	2.1
6	3.25	B ₁ F ₄	-45	2.01	2.1
7	3.25	B ₁ F ₆	-45	2.01	2.1
8	3.25	B ₁ F ₇	-45	2.01	2.1
9	3.25	B ₁ F ₉	-45	2.01	2.1
10	3.25	B ₁ F ₅	-45	2.01	2.1
11	3.25	B ₁ F ₅	0	2.01	2.1
12	3.25	B ₁ F ₈	0	2.01	2.1
13	3.25	B ₁ F ₈	-45	2.01	2.1
14	3.25	B ₂ F ₂	-45	2.03	2.1
15	3.25	B ₂ F ₈	-45	2.03	2.1
16	3.25	B ₂ F ₅	-45	2.03	2.1
17	3.25	B ₂ F ₅	0	2.03	2.1
18	3.25	B ₂	0	2.03	2.1
19	1.57	B ₂	0	5.97	4.2
20	1.57	B ₂ F ₅	0	5.97	4.2
21	1.57	B ₂ F ₅	-45	5.97	4.2
22	1.57	B ₂ F ₈	-45	5.97	4.2
23	1.57	B ₂ F ₂	-45	6.01	4.3
24	1.57	B ₁ F ₈	-45	6.01	4.3
25	1.57	B ₁ F ₈	0	6.01	4.3
26	1.57	B ₁ F ₅	0	6.01	4.3
27	1.57	B ₁ F ₅	-45	6.01	4.3
28	1.57	B ₁ F ₉	-45	6.01	4.3

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TABLE I (Cont.)

Run	M	Config.	θ°	q(psi)	$(Re/Ft) \times 10^{-6}$
29	1.57	B ₁ F ₇	-45	6.01	4.3
30	1.57	B ₁ F ₆	-45	6.01	4.3
31	1.57	B ₁ F ₄	-45	6.01	4.3
32	1.57	B ₁ F ₃	-45	6.01	4.3
33	1.57	B ₁ F ₂	-45	6.01	4.3
34	1.57	B ₁ F ₂	-45	6.01	4.3
35	1.57	B ₁ F ₂	0	6.01	4.3
36	1.57	B ₁ F ₁	-45	6.01	4.3
37	1.57	B ₁	0	6.01	4.3
38	0.90	B ₁	0	4.72	4.3
39	0.90	B ₁ F ₂	0	4.72	4.3
40	0.90	B ₁ F ₂	-45	4.72	4.3
41	0.90	B ₁ F ₁	-45	4.72	4.3
42	0.90	B ₁ F ₃	-45	4.72	4.3
43	0.90	B ₁ F ₄	-45	4.72	4.3
44	0.90	B ₁ F ₂	-45	4.78	4.3
45	0.90	B ₁ F ₇	-45	4.78	4.3
46	0.90	B ₁ F ₉	-45	4.78	4.3
47	0.90	B ₁ F ₅	-45	4.78	4.3
48	0.90	B ₁ F ₅	0	4.78	4.3
49	0.90	B ₁ F ₈	0	4.78	4.3
50	0.90	B ₁ F ₈	-45	4.78	4.3
51	0.75	B ₁	0	3.83	4.0
52	0.75	B ₁ F ₅	0	3.83	4.0
53	0.75	B ₁ F ₅	-45	3.83	4.0
54	0.75	B ₁ F ₄	-45	3.83	4.0
55	0.75	B ₁ F ₆	-45	3.83	4.0
56	2.17	B ₁ F ₆	-45	4.65	3.5
57	2.17	B ₁ F ₄	-45	4.65	3.5

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TABLE I (Cont.)

Run	M	Config.	θ°	q(psi)	(Re/Ft) $\times 10^{-6}$
58	2.17	B ₁ F ₅	-45	4.65	3.5
59	2.17	B ₁ F ₅	0	4.65	3.5
60	2.17	B ₁	0	4.65	3.5
61	2.17	B ₂	0	4.65	3.5
62	2.17	B ₂ F ₅	0	4.65	3.5
63	2.17	B ₂ F ₅	-45	4.65	3.5

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WTR RUN

461		C _N	C _B	C _A
θ				
4.02-		.1810-	1.0116-	.3027
4.02-		.2536-	.6590-	.2833
6.03-		.3949-	1.0706-	.2660
2.01-		.1595-	.1857-	.2628
	00	.0089-	.0058-	.2774
2.01		.1412	.2549	.2627
4.02		.3093	.4869	.2732
6.03		.4050	.8744	.2937
6.03		.4317	.2918	.2735
8.05		.6709	1.1794	.3020
10.06		.9823	1.3340	.3100
12.00	1.	.2764	1.4050	.3245
2.01-		.1132-	.4395-	.1954

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481	2		
8.03-	.8894-	.9958	.3653
6.02-	.9711-	1.2291	.3866
4.02-	.6109-	.6946	.3823
2.01-	.2696-	.3100	.3541
0.00	.0086-	.0462-	.3512
2.01	.2690	.2292-	.3264
4.02	.3396	.7008-	.3474
6.03	.8079-	.8088-	.3652
8.04	1.22569	1.2851-	.3777
10.05	1.6831	1.3730-	.3582
12.07	2.0724	1.8862-	.3843
2.01	.2871	.2580-	.3121

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481 3

6.02-	.7934-	.8530	.3297
4.02-	.5520-	.4385	.3974
4.02-	.5722-	.4825	.3813
2.02-	.2160-	.0286	.3453
.00	.0125	.0946	.3396
2.01	.2418	.3854-	.3395
2.01	.3293	.4144-	.3239
4.02	.6160	.7703-	.3225
6.02	.9274	.9373-	.3377
8.04	1.2337	1.3086-	.3346
10.06	1.6492	1.4931-	.2968
12.08	2.1263	1.5777-	.1231
12.08	2.0254	1.5065-	.3271
10.06	1.6622	1.3115-	.3338
6.02-	.8253-	.9184	.3400
4.02-	.5507-	.5548	.3787

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481 4

4.02-	.5449-	.5010	.3780
6.02-	.9219-	1.0557	.64061
2.01-	.2488-	.2368	.3917
4.00-	.0438-	.1153-	.3484
2.01-	.2990	.5489-	.6232
4.02-	.5893	.9319-	.3368
6.02-	.9928	1.1527-	.3514
8.04-	1.3753	1.6177-	.3087
10.06-	1.7760	1.8104-	.3355
12.08-	2.2505	2.2144-	.3297
4.02-	.6393	.8113-	.3357

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4.02-	.4475-	.3644	.3263
4.02-	.6961-	.3998	.3748
4.02-	.2341-	.1606	.3413
4.00	.0776-	.1501	.3147
2.02	.3766	.4405-	.3055
4.02	.4851	.6563-	.3379
5.02	.8209	.4608-	.3315
8.04	1.1561	.9864-	.3249
10.06	1.3530	1.0357-	.3157
12.08	1.8410	.9616-	.3006
4.02	.4549	.5319-	.3066
2.01	.1593	.0366-	.2998
3.02	.3846	.2350-	.3128
5.02	.6469	.6045-	.3205

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481 6

4.007-	1.5027-	.3849	.3222
6.002-	1.68071-	.5272	.3792
2.002-	1.2076-	.1210	.3245
1.000-	1.0002-	.1441	.3239
2.001	1.2494	.3515	.3177
4.002	1.5900	.4710	.3210
6.002	1.8829	.8802	.3328
8.004	1.2080	1.0667	.3300
1D.006	1.5682	1.2579	.3175
1E.006	2.0017	1.8657	.3208
2.001	1.2064	.0069	.3280
1.000	1.1339	.2279	.3111

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2.02-	.1875-	.0669-	.3017
4.02-	.3767-	.0083	.3390
6.02-	.7349-	.3174	.3659
8.00	.0063	.0042	.3059
2.01	.2531	.1619-	.3272
4.02	.44867	.44246-	.2924
6.02	.7581	.3883-	.3205
8.05	.11436	.4463-	.3222
10.07	.1.4803	.3952-	.3259
12.08	.1.7931	.4746-	.3041
1.04	.1.0298	.4651-	.3218
6.03	.7900	.2503-	.2890
4.02	.4550	.3018-	.3099
2.01	.2544-	.3197	.2942
4.02	.4359-	.1994	.3230
6.02	.7529-	.5067	.3502
3.02	.3615-	.3069	.3307

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481 1.8

2.02-	.2264-	.0800	.3195
4.02-	.4965-	.2448	.3294
6.02-	.6967-	.0830	.3676
.00	.0192	.0451-	.3105
2.02	.2587	.2910-	.2973
4.02	.4811	.2842-	.3186
6.03	.8019	.2142-	.3007
8.03	.1.1765	.3972-	.3222
10.06	1.5226	.6845-	.3158
12.08	1.7631	.5516-	.3008
4.02-	.4613-	.2400	.3201
6.03-	.7956-	.1320	.3644

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481 9

2.02-	.1434-	.0959-	.2736
4.02-	.3725-	.1906-	.3415
6.02-	.5345-	.4132-	.3421
.01	.1002	.0764-	.3054
2.02	.1889	.0106	.3033
4.02	.3833	.01685	.2999
6.02	.7153	.0424-	.3356
8.04	.1.0655	.2124-	.3029
10.07	.1.63179	.0431	.3028
12.08	.1.6361	.1108	.2832
2.02-	.1913-	.2142-	.2d21
3.02-	.2876-	.0957	.2984
5.02-	.4731-	.0840-	.3043
6.02-	.6658-	.0251-	.3397
.01	.0741	.1362	.2970

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AB1 10

2.02-	.2748-	.0470	.2945
4.02-	.3681-	.0725	.3653
6.02-	.8066-	.5279	.3411
.00	.0248-	.0128	.3168
2.01	.2747	.3637-	.3220
4.02	.4722	.3756-	.2373
6.02	.8001	.6760-	.3275
8.04	1.0287	.3906-	.3161
10.07	1.6005	.7764-	.3283
12.08	1.8368	1.1365-	.3512
6.02-	.7662-	.3535	.3540
.00	.0178-	.2185	.3174
8.04	1.1571	.8991-	.3336
4.02	.5309	.3651-	.3328

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4.01	1.972	.1546	.2997
4.02	1.7982	.6935	.3533
4.02	1.8920	.4010	.4214
4.02	1.0179	.0520	.3131
2.01	1.2696	.3100	.2984
4.02	1.5485	.5621	.3039
4.02	1.8736	.7972	.3025
4.01	1.1741	.8932	.3325
4.06	1.5485	1.2025	.3460
12.07	1.18728	1.3680	.2410
2.01	1.1787	.0451	.3045
4.02	1.5198	.3893	.3024
4.03	1.8244	.5952	.2940

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481 12

2.01-	.1957-	.0877-	.2936
4.02-	.4284-	.0436	.2792
6.03-	.7330-	.2496	.3625
8.04-	.0183	.0691-	.3099
10.01-	.2322	.0506-	.2925
12.02-	.5018	.3606-	.2912
14.03-	.7068	.3478-	.3472
16.04-	.0195	.4268-	.3075
18.06-	.4664	.5799-	.3303
20.07-	.7334	.4860-	.3458
22.03-	.7515	.3591-	.3358
24.05-	.7340-	.4111	.3484

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	13		
2.02-	.0793-	.6002-	.3291
6.02-	.6381-	.1365-	.2384
4.02-	.4175-	.3067-	.3488
.00	.0649	.1589-	.2365
2.02	.1818	.0800-	.2825
4.02	.4501	.1893-	.2986
6.02	.7631	.0476	.3106
8.04	1.0933	.1936-	.2926
10.07	.1.4141	.2093-	.2931
12.08	.1.7750	.0857-	.2604
2.02	.2624	.0887	.2944
.00	.0056-	.0540	.2946
2.01	.1102-	.2459-	.2546
4.02-	.4490-	.1041	.3320
5.02-	.5827-	.1855-	.3720

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481	14		
7.02	.2276-	.9368	.3509
4.03	.4832-	.0009	.3707
6.05	.8495-	.6984	.4008
.00	.0778-	.1973	.3647
2.02	.2478	.0625	.3521
4.03	.5708	.6718-	.3394
6.07	.8845	.6320-	.3236
8.08	1.64043	1.3184-	.3738
10.10	1.4524	.4370-	.3412
12.14	2.3569	2.0773-	.2559
12.13	1.9011	1.1927-	.2713
10.10	1.5376	.8464-	.3114
2.02	.2329-	.2762	.2886
2.02	.2332-	.2487	.3598

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2.02-	1504-	.0718-	.2486
4.04-	.4520-	.6459-	.3518
6.06-	.7156-	.0958-	.2462
4.04-	.5752-	.0390-	.3486
.00	.0069-	.1248	.3115
2.02	.1415	.2582	.3517
4.03	.4048	.3991	.5159
6.07	.7251	.3722	.2698
8.09	1.0499	.6251	.3255
10.13	1.6835	.1789	.3368
12.16	2.1639	.2664	.3092
6.07	.7791	.3510	.3191
2.02-	.2009-	.0294	.3158

NAWORD Report 6783

481 16

2.01-	.1070-	.1905-	.3912
4.02-	.4699-	.0981	.3963
6.06-	.68231-	.3153	.4141
.00	.0341-	.0091-	.3378
2.02	.1883	.0972-	.3429
4.04	.35991	.0236-	.3403
6.07	.8512	.2686-	.3215
8.09	1.3365	.2443-	.2885
10.12	1.7266	.3430-	.3419
12.16	2.3376	.9588-	.3523
2.02-	.2283-	.3267	.3293
4.03-	.5711-	.2126	.3440

NAWORD Report 6783

2.02-	2376-	.0588	.3403
4.03-	1563-	.1049	.3774
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24.02	2469	.1533-	.3580
4.03	.5197	.2224-	.3690
6.03	.8882	.7460-	.3721
8.03	1.3419	1.0424-	.3875
10.12	1.8783	1.1269-	.3410
12.15	2.2809	.8973-	.4019
4.04	.6180	.4854-	.3243
.00	.0631	.2526-	.2576
.00	.0355	.0811-	.3505
.00	.0633	.2937-	.2973
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.00	.0908	.4137-	.3070
.00	.1257	.4239-	.2895
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NAVORD Report 6783

2.02	.1194	.5157	.2604
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4.04	.1081	1.2969	.2531
6.06	.5327	1.9044	.2714
8.09	.0279	2.4507	.2574
10.11	1.2096	3.41560	.2544
12.17	1.4792	3.95030	.2508
8.10	.9954	2.61340	.2782
4.04	.85251	1.63939	.2505

NAVORD Report 6783

481 19

6.14-	.3556-	1.8548-	.4196
6.14-	.3522-	1.6202-	.4278
7.09-	.2254-	1.0032-	.4216
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4.91	.0111-	.3445	.4213
2.85	.0364	.9592	.4169
4.810	.2047	1.4573	.3918
6.15	.3262	1.9805	.3820
8.20	.4709	2.5934	.3935
6.14	.3645-	1.5557-	.4204
6.14-	.3492-	1.6325-	.4183
4.09-	.2071-	1.0843-	.4091
2.04-	.0954-	.4239-	.4073
.01	.0197-	.3022	.4147
2.05	.0831-	.9618	.3955
4.10	.1838	1.65366	.3866
6.15	.3291	1.9900	.3769
8.20	.4858	2.0132	.3921
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12.37	.9532	4.3079	.4024
12.37	.9383	4.3157	.4064

NAVORD Report 6783

491 20

4.08-	1.7409-	2.5456	.5331
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4.08.	1.6209	1.4145-	.5035
6.12	1.0237	2.6382-	.5054
8.16	1.4627	3.9550-	.5063
10.23	1.9659	5.0768-	.5129
6.11-	1.1612-	3.7261	.5174
6.11-	1.1673-	3.7486	.5220
6.11-	1.1735-	3.7848	.5398
4.01	1.0507-	4.5112	.5238
12.31	2.4177	5.5903-	.5083
12.31	2.4426	5.7773-	.5110
12.30	2.4153	5.6832-	.5211
12.31	2.4394	5.7315-	.5177
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11.26	2.1758	5.1929-	.5195
13.06	2.7079	5.9130-	.5018

NAWORD Report 6783

481

21

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2.05	.2632	.2888-	.5027
4.08	.6164	1.3088-	.4722
1.12	.9896	2.4060-	.4733
8.16	1.3638	3.4371-	.4763
10.23	1.8363	4.3744-	.4777
12.32	2.3001	4.9210-	.4700
12.32	2.3036	4.9366-	.4770

NAVORD Report 6783

481 22

2.02-	.2378-	.7576	.3088
4.08-	.5612-	1.3470	.5019
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4.09	.5371-	.5124-	.4826
6.12	.4847-	1.0930-	.4645
8.16	1.0764	1.5979-	.4613
10.25	1.3554	2.3314-	.4610
12.32	1.9071	2.3724-	.4600
12.32	1.9043	2.4134-	.4583
11.28	1.7411	2.3644-	.4610
10.24	1.5144	2.2439-	.4581
4.08	.5029	.5638-	.4649
2.05	.2436	.0501-	.4789
6.12-	.8755-	1.8743	.5070
2.03-	.2681-	.7725-	.4943
.01	.0407-	.3982	.5022
4.08-	.3751-	1.3762	.4837
4.08-	.5485-	1.2703	.4911
4.08-	.5677-	1.3174	.4896

MAVORD Report 6783

481 23

4.08-	.9401-	3.4079	.5555
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4.08	.7325	2.2332-	.5014
8.11	1.1311	3.6425-	.4903
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6.11	1.3524-	4.9430	.5555
.01	.0579-	.5848	.5524
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NAWORD Report 6783

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2.02	.2232	.1306-	.4511
4.03	.5054	.4634-	.4421
6.08	.8604	.9787-	.4304
8.12	1.1853	1.3594-	.4202
10.14	1.5367	1.8107-	.4097
12.17	1.9041	2.1540-	.4131
2.02	.2590	.2806-	.4419
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8.08-	.7913-	.9193	.4567
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NAWORD Report 6783

481 29

6.07-	.8465-	1.1158	.4857
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2.03-	.2555-	.2536	.4692
.00	.0063	.0502-	.4674
2.02	.2866	.4370-	.4512
4.05	.5726	.7928-	.4558
6.08	.9071	1.2527-	.4491
8.10	1.2049	1.5736-	.4403
10.14	1.6487	2.3150-	.4322
12.18	1.9658	2.3924-	.4307
6.08	.9163	1.2874-	.4436
10.14	1.6120	2.1761-	.4358

NAVORD Report 6783

481 26

4.04-	6984-	1.3215	.4829
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8.07	1.0884	2.0439-	.4665
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NAWORD Report 6783

481 27

6.07-	1.0017-	1.8591	.4822
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.00	.0063	.1307-	.4771
2.02	.3763	.6651-	.4658
4.04	.6710	1.2015-	.4548
6.08	1.0129	1.7548-	.4471
8.10	1.4104	2.4731-	.4338
10.12	1.8735	3.1770-	.4264
12.16	2.3142	3.9151-	.4196
4.05	.6678	1.0589-	.4485
6.07-	1.0068-	1.9422-	.4707
4.04-	.6191-	1.0434	.4799
2.02-	.2944-	.4885	.4343
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NAWORD Report 6783

482 28

6.07-	.7688-	.9536	.4487
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.00	.0020	.0373-	.4565
2.02	.2701	.2730-	.4471
8.04-	.5006	.5150-	.4382
8.08	.7642	.7636-	.4265
8.11	1.1181	1.1028-	.4144
10.14	1.4128	1.4498-	.4023
12.18	1.7630	1.6507-	.3999
2.02-	.2677-	.2651	.4408

NAVORD Report 6783

6.03	.8928-	1.1163	.4719
4.05-	.5407-	.6043	.4714
2.02-	.2630-	.2203	.4786
.00-	.0071	.0825-	.4733
2.02-	.2718-	.2332-	.4587
4.08-	.8690	.5366-	.4543
8.08	.8866	.9035-	.4438
8.12	1.2643	1.8293-	.4328
10.16	1.6596	1.9894-	.4255
12.18	2.0901	2.5512-	.4259
8.12	1.2550	1.53584	.4259
6.08	.8794	.9471-	.4373
4.06	.5737	.5526-	.4506

NAVORD Report 6783

681 30

6.06-	.8857-	1.6275	.4750
4.03-	.5878-	1.0740	.4645
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.00	.0086	.0522-	.4750
2.02	.3347	.6734-	.4629
4.04	.6136	.9868-	.4508
6.08	.2802	1.6414-	.4416
8.10	1.3300	2.8471-	.4403
10.12	1.6872	2.6057-	.4278
12.16	2.1950	3.3968-	.4268
12.16	2.1590	3.1991-	.4197
8.10	1.3390	2.1449-	.4343
10.12	1.7172	2.7698-	.4324
2.02-	.3196-	.5295	.4643

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81

31

6.07-	1.0965-	1.9191	.5017
4.04-	.6972-	1.8092	.5055
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.00	.0236	.1193-	.4978
2.05-	.3679	.6127-	.4806
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6.08-	1.1275	1.8515-	.4884
8.12-	1.5762	2.7001-	.4539
10.14-	2.0290	3.85169-	.4368
12.16-	2.95219	4.4130-	.4440
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10.14-	2.0617	3.7168-	.4435
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4.05-	.6984-	1.1839	.5031

NAWORD Report 6783

481 32

6.05-	1.0691-	2.3632	.4824
4.03-	.6986-	1.5111	.4831
2.02-	.3546-	.7282	.4863
.00	.0110-	.0311	.4942
2.02	.3803	.7974-	.4788
4.04	.7403	1.5892-	.4651
6.07	1.0911	2.1940-	.4521
8.08	1.4204	2.6497-	.4353
10.12	1.8959	3.7982-	.4403
12.16	2.3347	4.1901-	.4322
10.11	1.9036	3.8223-	.4340
8.09	1.5159	2.9717-	.4345
12.16	2.3575	4.3679-	.4377
10.12	1.9247	3.7386-	.4385

NAVORD Report 6783

401 33

4.04-	.7596-	1.6920	.4918
6.07-	1.1900-	2.6686	.4942
2.02-	.3369-	.7106	.5078
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2.02	.4288	.8997-	.4939
4.04	.8953	1.8886-	.4799
6.08	1.2529	2.7227-	.4670
8.08	1.6784	3.6251-	.4527
10.12	2.1804	4.7177-	.4460
12.15	2.6768	5.4957-	.4488
8.08	1.7165	3.7540-	.4496
2.02	.4084	.9234-	.4873

NAWORD Report 6783

481 34

6.05-	1.1620-	2.6981	.4987
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2.02-	.3805-	.7007	.4933
.00	.0138	.0967-	.5067
2.02	.4270	.9105-	.4917
4.04	.8211	1.7858-	.4737
6.07	1.2686	2.7506-	.4639
8.08	1.6976	3.7567-	.4433
10.12	2.2327	4.8273-	.4408
12.16	2.6717	5.4601-	.4411
12.15	2.7262	5.7131-	.4432
4.04	.8272	1.7722-	.4645
2.02-	.3577-	.6776	.4962

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481 - 35

4.04-	.7863-	1.6974	.4982
6.06-	1.2126-	2.7775	.4899
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4.04	.9190	2.1021-	.4905
3.06	1.3005	2.9915-	.4615
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10.11	2.1382	4.8885-	.4670
12.15	2.8202	6.1617-	.4755
12.19	2.7984	6.0166-	.4708
12.15	2.7922	5.9799-	.4740
10.11	2.2790	5.1346-	.4711
12.15	2.7736	5.8699-	.4697
8.09	1.8034	4.0881-	.4738
6.06	1.3127	3.0243-	.4848
2.02-	.3691-	.7360	.4978
2.03-	.3745-	.6374	.5092

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481 36

6.07-	1.2752-	2.8622	.5144
4.04-	.8540-	1.8992	.5177
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4.05	.9150-	1.9834-	.4979
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10.12	2.4269	5.4207-	.4649
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481 37

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.00	.0184	.0695-	.3841
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4.06	.2404	.7145	.3859
6.09	.3418	1.2021	.3605
8.13	.4432	1.47032	.3542
10.16	.5750	2.1156	.3540
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12.20	.8486	2.3085	.3654
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6.09-	.2412-	1.5300-	.3778
4.05-	.1987-	.6872-	.3861
2.03-	.0316-	.6727-	.3856
2.03-	.1023-	.3523-	.3815
2.03-	.0392-	.5550-	.3797
4.06-	.2010-	.77974-	.3889
6.06-	.1389-	1.1777-	.3768
6.10-	.3583-	1.2775-	.3758
10.16	.6139	2.1003	.3607
12.20	.8241	2.4011	.3634
.01-	.0469-	.1194-	.3879
.01-	.0103-	.2913-	.3890
.00	.0088	.0194	.3858
2.03-	.0502-	.5626-	.3894
4.06-	.1183-	1.1234-	.3883
6.08-	.2698-	1.2500-	.3806
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481 38

6.06-	.1516-	1.2939-	.0810
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.00	.0158	.6935-	.0609
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4.03	.1140	.6287	.0743
6.05	.1678	1.1487	.0715
8.07	.3035	1.3588	.0757
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12.12	.5041	2.1481	.0482
12.12	.5551	1.9046	.0479
10.10	.4193	1.7437	.0714
2.02	.0578	.4880	.0607
4.04	.1170	.7516	.0752

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481 39

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.00	.0194	.0565-	.1783
2.01	.4254	1.0968-	.1750
4.02	.8411	2.3569-	.1891
6.03	1.3919	3.9520-	.1946
8.04	1.9378	5.3773-	.1987
10.05	2.5506	7.1567-	.1604
12.07	3.0284	8.4296-	.2008
6.04	1.4328	3.8040-	.1932
6.03	1.4192	4.0233-	.1897
4.03	.8773	2.0562-	.1836
4.02	.8951	2.4600-	.1730
2.01	.4534	1.2608-	.1604

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481

6.03-	1.2519-	3.1452	.1908
4.02-	.8069-	2.1997	.2008
2.02-	.3546-	.6275	.2003
.01	.0755	.1564-	.1768
2.02	.4016	1.0345-	.1742
4.02	.7918	1.8817-	.1975
6.04	1.3081	3.2290-	.1954
8.04	1.8561	4.9818-	.1450
10.05	2.3341	6.2198-	.1238
12.08	3.0348	8.1124-	.1119
.00	.0376-	.0120	.1728
4.02	.7318-	1.8365	.1946
6.04	1.2589-	3.0190	.1843
4.02	.7640-	1.7781	.1894
10.05	2.3174	6.4497-	.1531
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481 41

4.04	1.2854-	9.1581	.1978
4.03	.8196-	1.9123	.1961
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1.00	.0380-	.1337	.1862
12.02	.3854	.8874-	.1635
4.02	.8534	1.9485-	.2003
6.04	1.3332	9.3338-	.1836
8.07	2.1300	4.47864-	.1636
10.08	2.4983	6.63897-	.1268
12.09	3.82448	8.2726-	.1500
12.10	3.22356	7.9373-	.1422
12.10	3.2353	8.1984-	.1643
8.08	1.9694	4.7471-	.1472
6.05	1.4737	2.8858-	.1804
4.02	.8590	2.1526-	.1831
4.02	.8565	2.0333-	.1886
.01	.0098-	.1653-	.1757
.00	.0042-	.0026-	.1842
4.03	.8829	1.9521	.1862
4.02	.7345-	1.6892	.1969
2.05	1.2995-	3.0793	.1848
3.024	.5112-	1.1441	.1808
5.044	1.0930-	2.4108	.1911
4.03	.8311-	1.6368	.1731
4.03	.8612-	1.65955	.1910

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481 42

6.02-	1.1741-	3.0987	.1741
4.02-	-.7532-	1.9077	.1742
2.02-	-.3856-	1.0690	.1778
4.01	.0630-	.9355	.1733
2.02	.3949	1.0630-	.1477
4.02	.7711	2.1386-	.1855
6.03	1.1563	2.9533-	.1691
8.03	1.7223	4.3762-	.1411
10.07	2.3393	6.0940-	.1290
12.07	2.7539	7.4345-	.1244
4.05	.0189	.0609	.1573
8.05	1.6502	4.2054-	.1321
10.06	2.3394	6.8005-	.1319
12.06	2.4468	7.5090-	.1163
12.06	2.7098	7.5018-	.1142
10.04	2.1860	6.2331-	.1186
8.02	1.6652	4.7672-	.1279
4.02-	-.7314-	1.9581	.1713

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481 443

5.06-	1.0526-	1.9942	.11742
4.02-	1.5830-	1.1569	.11740
2.02-	1.5009-	1.5176	.11735
1.01-	1.0594-	1.0459	.11601
2.03	1.3658	1.4370-	.11467
4.02	1.6345	1.2675-	.11552
6.05	1.00044	1.9349-	.11706
8.07	1.5814	3.2785-	.11490
10.08	1.9819	1.41307-	.11177
12.12	2.7463	5.4951-	.11169
4.03	1.6647	1.1507-	.11720
2.02	1.3400	1.5277-	.11524
8.07	1.4982	3.1510-	.11436
6.06	1.9986	1.7926-	.11642
6.05	1.9559	1.7475-	.11665
2.02	1.2502	1.3442w	.11588
4.04	1.6698	1.00617-	.11670
4.03	1.6574	1.1683-	.11509
6.04	1.0524	2.0975-	.11537
10.08	2.0178	4.1552-	.11182
10.08	1.9401	4.2433-	.11206
12.10	2.5250	3.6182-	.11117

NAVORD Report 6783

6.03	1.8340	2.2749	.1111
8.5024	.5916	1.0372	.1424
2.602	1.8332	1.4331	.1390
1.00	1.0535	1.1224	.1426
2.01	1.2000	1.5216	.1223
4.102	1.5772	1.2661	.1560
4.094	1.0081	2.2884	.1341
3.06	1.3493	2.9834	.1065
10.06	1.7042	4.0743	.1178
12.08	2.2470	3.1588	.0989
8.06	1.4338	2.3878	.1152
6.03	1.0394	2.4378	.1468
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1.00	1.0257	1.0681	.1338
4.02	.6326	1.3494	.1853

NAWORD Report 6783

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	.0507	.0386	.1257	
	.2437	.2868-	.1161	
	.6208	.7083-	.1381	
	.7960	.9623-	.1641	
	.8607	.1.1208	.1.7762-	.1320
	.1010	.1.5755	.2.5297-	.1309
	.2356	.1.8963	.3.3817-	.1089
	.8607	.1.1197	.1.8871-	.1352
	.00	.0138	.0758-	.1342
	.6082	.8464	.1.1957-	.1458

NAVORD Report 6783

6.03-	6830-	1.1577	.1152
4.02-	6465-	.8773	.1146
2.02-	2060-	.3114	.1343
5.00-	50307-	.0326-	.1227
2.02-	2142-	.2576-	.1852
4.02-	40054-	.4733-	.1554
6.04-	7328-	1.1816-	.1356
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10.08-	1.4239-	2.05531-	.1159
12.09-	1.6615-	3.1738-	.1152
12.09-	1.7605-	3.2584-	.1103
12.10-	1.6836-	2.6758-	.1141
6.04-	6937-	1.0423	.1476
4.02-	4846-	.7326	.1378
2.02-	.2518-	.3176	.1332
6.01-	.0304-	.1301-	.1319
2.02-	.4623-	.2069-	.1351
6.03-	.4396-	.7036-	.1720
6.04-	.6833-	1.1224-	.1603

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481 47

6.04	.9929-	1.9950	.1189
4.02	.6452-	1.3048	.1654
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8.00	.0130-	.1976-	.1597
2.02	.9502-	.6158-	.1702
4.02	.6516	1.4708-	.1990
6.03	.9895	2.2289-	.1755
8.07	1.4256	2.9929-	.1574
10.07	1.8298	4.2283-	.1551
12.10	2.3897	5.3582-	.1392
12.06	2.3893	5.5177-	.1409
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8.06	1.3911	3.0891-	.1610
6.04	1.0141	2.0541-	.1941
4.02	.5860	1.1379-	.1806
2.02	.2291	.5028-	.1619
.00	.0019	.0615	.1653

NAVORD Report 6783

481 48

2.01	.3094	.7715-	.1468
4.03	.6481	1.4213-	.1677
4.04	1.0573	2.5036-	.1627
8.05	1.6076	3.9206-	.1612
10.07	2.0552	5.1315-	.1516
12.09	2.6229	6.3340-	.1509
6.05-	1.0510-	2.1145	.1603
4.03-	.6322-	1.2779	.1737
2.02-	.3539-	.6740	.1543
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4.03	.6277	1.1612-	.1619
4.03-	.7553-	1.7271	.1718

NAWORD Report 6783

481 49

6.04-	.8329-	1.5054	.1471
4.04-	.4765-	.4398	.1504
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2.02	.2001	.1423-	.1255
4.03	.4619	.5177-	.1409
6.04	.7796	1.4035-	.1399
8.06	1.2031	2.3908-	.1304
10.08	1.5945	3.0403-	.1158
12.09	2.1273	4.6569-	.0966
2.01	.2014	.3466-	.1120
.00	.0155	.0753-	.1139
4.03	.5167	.8579-	.1455
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NAWORD Report 6783

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6.03-	.7225-	1.2904	.1335
4.05-	.5679-	.4702	.1286
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.00	.0543-	.1940	.1327
2.02	.2205	.3149-	.1267
4.02	.3785	.4756-	.1442
6.05	.6451	.6873-	.1469
8.05	.9606	1.7628-	.1157
10.08	1.3375	2.4118-	.1151
12.10	1.7447	2.8555-	.1057
12.09	1.7980	3.3159-	.0913
8.07	1.1193	1.9601-	.1176
4.03	.4856	.5748-	.1556
4.03	.4476	.5507-	.1444
6.03-	.7289-	1.4319	.1490
4.02-	.4465-	.6837	.1510
4.03-	.5113-	.7402	.1508
2.01-	.1646-	.3397	.1554
2.02-	.2470-	.3456	.1405
.00	.0053	.0207-	.1129

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481 51

6.04-	.1186-	1.2507-	.0533
4.03-	.1166-	.8441-	.0864
2.02-	.0919	1.1756-	.0529
.01	.0847	.0511-	.0758
2.01	.1810	.4358-	.0671
4.03	.0490	1.1410	.0575
6.04	.2616	.8965-	.0533
8.06	.3020	1.1789	.0271
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12.09	.4846	1.9597	.0683
10.06	.4483	1.0402	.0239
10.06	.4967	.7948	.0259
10.07	.2739	1.9706	.0020-
12.07	.4805	1.4256	.0007-
2.02-	.1390	1.2097-	.0369
.00	.0150	.1395-	.0325
2.03	.1991-	1.8101	.0459
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NAVORD Report 6783

481 52

6.03-	1.0511-	2.2966	.1340
4.03-	.7074-	1.3490	.0850
2.01-	.1501-	.0082	.0730
.01-	.0208	.3275-	.1074
2.01	.0648	.1278	.0286
4.02	.6603	1.3159-	.0791
6.04	.9113	1.7058-	.0928
8.03	.4973	3.8807-	.0671
10.05	1.9381	4.6153-	.0718
12.07	2.4276	5.6167-	.0463
12.07	2.3465	5.4139-	.0617
6.03	1.0325	2.3301-	.0788
8.03	1.4686	3.7929-	.0492
4.02	.6325	1.3767-	.0781
2.01	.2205	.5326-	.0931
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2.01	.3055	.8447-	.0960
8.04	1.5631	3.9015-	.0794

NAWORD Report 6783

481 53

6.03-	.9201-	1.7019	.0951
4.02-	.5745-	1.2071	.0932
2.01-	.2260-	.3044	.1376
.01-	.0465	.0164	.1207
2.00	.2019	.5766-	.0736
4.02	.5898	1.0743-	.1223
6.03	.9057	1.0332-	.0547
8.05	1.3589	2.0536-	.0335
10.06	1.7451	3.0927-	.0322
12.08	2.1869	4.05511-	.0358
4.02	.5391	1.0785-	.0706
2.02-	.2671-	.3364	.1077
4.02-	.5641-	1.0470	.1250
4.02-	.6162-	1.0428	.0946

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481 54//

6.08-	.9500-	1.4098	.1412
4.03-	.6256-	1.0217	.1354
2.02-	.2651-	.4743	.1305
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2.01	.2695	.6381-	.1041
4.02	.6604	1.1487-	.0704
6.03	.9624	1.8863-	.0910
8.05	1.3921	2.9921-	.0371
10.06	1.9112	4.3573-	.0447
12.08	2.2802	4.8380-	.0433
10.06	1.8047	3.9747-	.0394
7.04	1.1488	2.4737-	.0529
7.04	1.1628	2.2376-	.0500
10.07	1.9490	4.1048-	.0542
10.08	1.8855	3.9808-	.0442
12.08	2.4579	5.4153-	.0380
9.06	1.6335	3.3013-	.0628
4.03	.6590	1.0131-	.0868
6.03-	1.0213-	2.2101	.1361

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481 55

6.03-	.9066-	2.0304	.1003
4.03-	.5836-	.8060	.0944
2.01-	.1733-	.2795	.1052
.01-	.0128-	.2352	.0688
2.01	.3295-	.8540-	.1306
4.02	.6405-	1.5243-	.0639
6.02	.8804	2.0929-	.0861
8.02	1.82761	3.1293-	.0656
10.06	1.86216	3.5815-	.0660
12.08	2.0471	4.3578-	.0623
8.05	1.3336	2.7430-	.0748
.01-	.0084	.1452-	.1019
2.01	.2686	.6538-	.1291
4.02	.4722	1.0935-	.0527
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6.02-	.8860-	1.8614	.0973

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481 56

6.08-	.7609-	.5587	.3764
6.06-	.6636-	.55819	.3789
4.03-	.4322-	.3739	.3621
2.02-	.2100-	.1974	.3401
8.00	.0569-	.0992-	.3305
2.02	.3247-	.3324-	.3475
4.04	.5701	.5059-	.3459
6.08	.8939	.7895-	.3531
8.10	.1.2240	.9310-	.3658
10.13	.1.5592	.1.1550-	.3716
12.19	.2.0876	.1.2040-	.3729
6.08	.0431	.7109-	.3513
6.07-	.7628-	.6400	.3598
4.03-	.4300-	.3005	.3554

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481	57		
4.07-	.9074-	1.1354	.3835
4.02-	.5613-	.7616	.3717
2.02-	.2553-	.3168	.3585
.00	.0431	.0459-	.3434
2.02	.3555	.4742-	.3520
4.04	.6706	.8632-	.3540
6.08	1.0423	1.3142-	.3706
8.10	1.4614	1.7216-	.3668
10.14	1.9183	2.1033-	.3708
12.18	2.4505	2.4977-	.3750

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481 58

2.01-	.2148-	.3067	.3368
4.03-	.5252-	.6113	.3642
6.07-	.8467-	.9210	.3788
.00	.0285	.0433-	.3265
2.02	.2960	.3144-	.3485
4.05	.6491	.7400-	.3698
6.08	.9642	1.0669-	.3951
8.11	1.3365	1.3308-	.3717
10.14	1.7552	1.5388-	.3645
12.18	2.2632	1.8117-	.3664

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481

59

6.06-	.8880-	1.0352	.3856
6.06-	.9314-	1.1650	.3858
4.04-	.5527-	.5870	.3736
2.02-	.2723-	.2610	.3596
.00	.0119	.0449-	.3511
2.02	.2924	.3884-	.3911
4.04	.6042	.7817-	.3602
6.06	.9508	1.1874-	.3622
8.10	1.3672	1.6175-	.3775
10.13	1.8302	2.0700-	.3880
12.18	2.3699	2.4370-	.3692
4.04	.6116	.7242-	.3449

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481 60

6.07-	.8201-	1.3349-	.2989
4.05-	.1756-	.0689-	.2931
2.02-	.0864-	.2907-	.2838
.00	.0156	.0249-	.2608
2.02	.0937	.4657	.2620
4.05	.2146	.8966	.2995
6.08	.3982	1.2103	.2996
8.11	.6517	1.4644	.2932
10.15	.9676	1.6363	.3034
12.20	1.3371	1.8961	.3122
12.20	1.3488	1.8861	.3090
10.15	.9830	1.6454	.3128

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481

61

6.13	.4260	2.0233	.3737
4.08	.2703	1.2982	.3919
2.04	.0792	.7473	.3544
.00	.0153	.0044	.3437
2.04	.1095	.7916	.3359
4.08	.2547	1.3550	.3218
6.15	.5876	1.8081	.2967
8.21	.7880	2.6972	.3411
10.29	1.1262	3.5109	.3643
12.38	1.5068	4.2635	.3761

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481 62

4.07-	.5586-	.8573	.4079
2.03-	.2620-	.4126	.4074
6.12-	.9394-	1.3531	.4355
.00	.0396	.2329-	.4165
2.03	.3174	.7208-	.4148
4.07	.6323	1.0514-	.3999
6.12	.9984	1.6492-	.4026
6.12	.0139	1.6891-	.3979
8.15	.1.4941	2.2049-	.4162
10.27	.2.0847	2.7041-	.4105
12.37	.2.6763	2.7477-	.4137
12.36	.6305	2.7521-	.4118
10.27	.0.768	2.6876-	.4021
6.11	.9262-	1.4540	.4207
4.07-	.5461-	.6988	.4002

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4.004	1.93962	1.7864	1.4247
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2.004	1.1950	1.6307-	1.3911
4.008	0.9339	1.0117-	1.3902
6.12	0.9867	1.3499-	1.3855
0.20	1.0486	1.6072-	1.3980
10.29	1.67739	1.8038-	1.3671
32.37	2.04481	1.48705-	1.6173
12.58	2.46645	1.36419-	1.6078
6.12	1.9814	1.3786-	1.6078